

Quadratic Equations: Back to the Future

In Algebra I we learned about quadratic equations, the zero product property, roots of equations, etc. It's time for a refresher!

Recall that a quadratic equation is one of the form:

$$ax^2 + bx + c = 0$$

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The Zero Product Property

The ZPP states that if $ab = 0$ then $a = 0$; $b = 0$ or both $= 0$.

That allows us to do is set different parts of equations equal to zero to solve them:

$$(x + 3)(y - 4) = 0 \quad \leftarrow \text{either or both terms equal zero, so...}$$

$$x + 3 = 0; \text{ } x = -3$$

and/or

$$y - 4 = 0; \text{ } y = 4$$

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The Quadratic Equation

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$7x^2 + 6x - 1 = 0$$

The equation is in standard form.

$$(7x - 1)(x + 1) = 0$$

Factor.

$$7x - 1 = 0 \quad \text{or} \quad x + 1 = 0$$

Use the Zero-Product Property.

$$x = \frac{1}{7} \quad \text{or} \quad x = -1$$

Solve for x .

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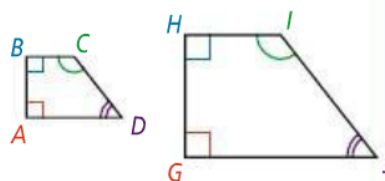
Similar Polygons

Define

Two polygons are **similar polygons** if corresponding angles are congruent and if the lengths of corresponding sides are proportional.

Diagram

$$ABCD \sim GHIJ$$



Symbols

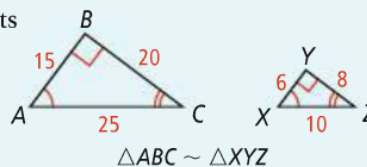
$$\begin{aligned} \angle A &\cong \angle G \\ \angle B &\cong \angle H \\ \angle C &\cong \angle I \\ \angle D &\cong \angle J \\ \frac{AB}{GH} &= \frac{BC}{HI} = \frac{CD}{IJ} = \frac{AD}{GJ} \end{aligned}$$

This definition is incredibly important: memorize it!

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You write a similarity statement with corresponding vertices in order, just as you write a congruence statement. When three or more ratios are equal, you can write an **extended proportion**. The proportion $\frac{AB}{GH} = \frac{BC}{HI} = \frac{CD}{IJ} = \frac{AD}{GJ}$ is an extended proportion.

A **scale factor** is the ratio of corresponding linear measurements of two similar figures. The ratio of the lengths of corresponding sides \overline{BC} and \overline{YZ} , or more simply stated, the ratio of corresponding sides, is $\frac{BC}{YZ} = \frac{20}{8} = \frac{5}{2}$. So the scale factor of $\triangle ABC$ to $\triangle XYZ$ is $\frac{5}{2}$ or 5 : 2.



The symbol \sim means "similar".

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Example

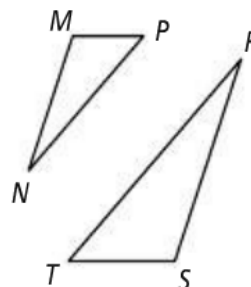
$$\triangle MNP \sim \triangle SRT$$

A What are the pairs of congruent angles?

$$\angle M \cong \angle S, \angle N \cong \angle R, \text{ and } \angle P \cong \angle T$$

B What is the extended proportion for the ratios of corresponding sides?

$$\frac{MN}{SR} = \frac{NP}{RT} = \frac{MP}{ST}$$



Redraw the polygon(s) if you have to!

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Example

Are the polygons similar? If they are, write a similarity statement and give the scale factor.

A $JKLM$ and $TUVW$

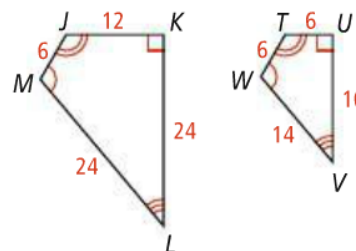
Step 1 Identify pairs of congruent angles.

$$\angle J \cong \angle T, \angle K \cong \angle U, \angle L \cong \angle V, \text{ and } \angle M \cong \angle W$$

Step 2 Compare the ratios of corresponding sides.

$$\frac{JK}{TU} = \frac{12}{6} = 2 \quad \frac{KL}{UV} = \frac{24}{16} = \frac{3}{2}$$

$$\frac{LM}{VW} = \frac{24}{14} = \frac{12}{7} \quad \frac{JM}{TW} = \frac{6}{6} = 1$$



Are the polygons similar? Why or why not?

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Example

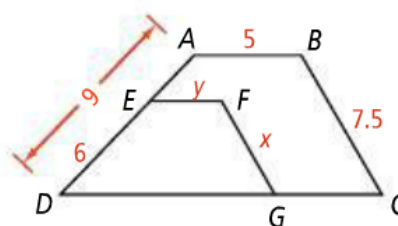
Algebra $ABCD \sim EFGD$. What is the value of x ?

(A) 4.5

(C) 7.2

(B) 5

(D) 11.25



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Example

Algebra $ABCD \sim EFGD$. What is the value of x ?

☐ A 4.5

☐ C 7.2

☒ B 5

☐ D 11.25

$$\frac{FG}{BC} = \frac{ED}{AD}$$

Corresponding sides of similar polygons are proportional.

$$\frac{x}{7.5} = \frac{6}{9}$$

Substitute.

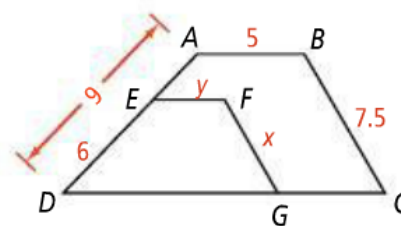
$$9x = 45$$

Cross Products Property

$$x = 5$$

Divide each side by 9.

The value of x is 5. The correct answer is B.



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